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of its greater diameter and the more unfavorable conditions of the catenary curve, or sag, on long spans and steep grades; and these sources of increased cost of maintenance affect every part of the rope. In this system the carrying-cable, being stationary, can be locally graduated to the strains it has to bear. The cable for the empty cars does not, of course, require to be as strong as the cable for the loaded cars, and it is therefore made only strong enough for the work it has to perform. In like manner, if one or more long spans occur in the line, it is not necessary that the whole cable should be made strong enough to bear the extra strain at this one point: on the contrary, it is sufficient to so strengthen only the portions exposed to this extra strain, and this is easily practicable. On very long steep grades also, where the cable at the head of the incline must be able to bear not only the ordinary working strain due to the cars, but must also sustain the whole weight of the cable on the incline, this is effected by making the cable in sections of gradually diminishing area, thus effecting great economy in the total weight of the cable. A further advantage is, that the traction-rope used, instead of being loaded down by the cars, as in other systems, is itself carried and supported by them, thus lessening greatly the wear.

The ordinary spans used in the construction of these lines are from 150 to 200 feet, but there is no real objection to spans of 500 to 600 feet. Many lines built within the last few years have spans up to 1,500 feet. The illustration on the first page, taken from a photograph, represents one of these long spans. It is 1,000 feet in the clear, and forms part of a line nearly seven miles in length, built for the transportation of 250 tons of iron ore per day. This line has been in successful operation for many years.

There exists in nature hardly a difficulty or obstacle which would bar the introduction of this system of transportation: in fact, in many cases it is the only one that can be used. While this is eminently true where the contour of the ground is much broken up and long spans are necessary, this system possesses economical advantages even where there are few or no natural obstacles to the building of any kind of road. The service is regular; stoppages for repairs are rare; no interruptions due either to atmospheric influences or storms are liable to occur; the line being elevated, the service is entirely free from interference with surface traffic; wear and tear and expense of operating are relatively very low; terminals can be so arranged that the material transported can be delivered at the exact spot where it is needed, thus saving all expense of re-handling. This could not be done with a surface road, since, even if the cars could be brought close to the point at which the material is required, there would still be a further expense for unloading, irrespective of the cost of switching and hauling them.

This system of transportation is controlled in this country by the Trenton Iron Company of Trenton, N.J.

THE SIGNIFICANCE OF THE DEGREE OF BACHELOR OF ARTS.

At the conference of college presidents and professors in Philadelphia, Nov. 26, 1889, Professor E. H. Griffin read a letter from President Gilman, dated Oct. 17 (published in the February number of the *Johns Hopkins University Circulars*) as follows:—

"If I had been present, I should have asked leave to present to your consideration some thoughts respecting the baccalaureate degree; but as I cannot attend, on account of absence from the country, I have requested Professor E. H. Griffin to say a few words in my behalf.

"The points to which I should have directed attention are these:—

"1st, The American propensity to multiply academic titles so that the real significance of a degree is obscured.

"2d, The tendency to confer the baccalaureate degree in so many forms and phrases that its meaning cannot be discovered even from the name of the institution which confers it, but

must often be worked out by a study of catalogues constructed in different orders of complexity.

"3d, The enumeration of the manifold forms of the baccalaureate degree now given in this country.

"4th, The historical significance of the bachelor's degree as marking attainment of the first grade in the fellowship of scholars, — a grade which may be attained in any faculty of a university, arts, medicine, theology, and law.

"5th, The value of a certificate the meaning of which is obvious at first sight, considered from the point of view of the holder of a diploma, and, second, from that of the public.

"6th, The importance of restoring, if possible, the baccalaureate degree to an honorable significance before it is altogether lost.

"7th, The importance of acknowledging that it is not essential that any one curriculum should be followed in order to attain the degree of bachelor of arts.

"8th, It is essential that the candidate who receives that degree should have received much instruction in (a) ancient and modern languages and literature, (b) in mathematics, (c) in the natural and physical sciences, and (d) in historical and moral sciences.

"9th, It is also essential that the candidate should pursue these studies in a public institution, under competent instructors, for a definite period, in a systematic way, subject to examination, the results of which are to be recorded, proclaimed, and certified to by a formal diploma." . . .

After reading the letter, Professor Griffin stated that there could be no doubt that the baccalaureate degree had lost something of the "honorable significance" of which President Gilman speaks. A recent writer in one of our magazines declares that "A. B. is as meaningless an abbreviation as exists." This, we are glad to know, continued Professor Griffin, is an exaggeration; but it is an exaggeration which contains an uncomfortable element of truth.

So far as it is true that the bachelor's degree has declined in dignity and value, the evil is a serious one. In view of its historical significance, the interests of learning and the credit of the fellowship of scholars require that this title, which marks the completion of a defined stage or period of training, should be kept in its original repute. It is a grave injustice that one who has gained the degree, at great expenditure of money, time, and labor, should find that others have gotten it upon so much easier terms that it becomes almost worthless as a guaranty of acquisition. The public have a right to assume that learned distinctions are bestowed in good faith, and upon some basis of common understanding, and ought not to be compelled to go back of academic titles to find out what they mean. Whether it be considered from the point of view of the public, or of the individual, or of the general interests of learning, few academic questions are of greater consequence than the proper significance, and most effective defence and maintenance, of the bachelor's degree.

The causes which have contributed to this loss of consideration are — some of them, at least — obvious.

As is well known, the institutions of higher learning first established in this country were modelled, not after the English universities, but after the English colleges. This was inevitable under the circumstances, and the American college has certainly shown itself well adapted to the conditions of our national life. As respects academic titles, however, the system has had its drawbacks. In Great Britain and Ireland there are eleven institutions conferring degrees; in the United States there are about four hundred, not counting colleges for women, of which there are perhaps one hundred exercising this prerogative. These institutions are, of course, of all grades of merit. Some of them are not greatly unlike the college in the Far West, of which Professor Bryce speaks in the "American Commonwealth," whose president had much to say about the views of his faculty, and what his faculty were going to do; the "faculty" consisting at the time, as it appeared, of that dignitary and his wife. A peculiar infelicity has attended our system as applied to honorary degrees, — as in theology and

law, — these being given by institutions which offer no instruction in these subjects. An eminent American composer is said to have declined the doctorate of music conferred by Yale, on the ground, that, as the university did not recognize this subject in its system of education, it was presumably incompetent to pronounce judgment about it. However uniform and thorough might be the standard of acquirement theoretically established by our colleges, their inordinate number, involving wide diversities of scholarly and teaching power, must prevent their certificates of graduation from bearing any thing like a uniform significance in respect to the amount and quality either of the instruction offered or of the proficiency attained.

So far as the bachelor's degree has suffered from this cause, there is probably no immediate remedy. The suggestion occasionally made, that the colleges of a State, or of a larger extent of territory, might, for certain purposes, affiliate themselves into a kind of university, and bestow degrees through a common board, is not likely to be received with favor. It is possible that something may be done toward the creation of a public sentiment unfavorable to the endowment and chartering of unnecessary institutions; but the main reliance must be upon such a gradual increase of resources and elevation of standards as shall diminish the evils which cannot be wholly removed. If an agreement of theory and practice could be reached among our most influential institutions in regard to the bachelor's degree, this would do more than any thing else to determine usage, and to fix the connotation of the title.

In looking over the reports of the commissioner of education, one is struck with the fertility of imagination and invention displayed in academic titles. The following enumeration of variations of the baccalaureate title is probably not exhaustive:—

Bachelor of arts, science, philosophy letters, laws, divinity, sacred theology, surgery, music, painting, pedagogics, English, English literature, Latin letters, agriculture, scientific agriculture, agricultural science, architecture, engineering, civil engineering, mining engineering, metallurgical engineering, mining metallurgy, chemical science, mechanic art, veterinary science, domestic art. The colleges for women add a new and pleasing element of variety from the fact that it seems to be supposed by some that the word "bachelor" is a designation of sex; and so we have licentiate, laureate, graduate, proficient, and, in more distinct antithesis to bachelor, maid.

The first criticism that one passes upon this list is that most of the titles indicate professional rather than liberal acquirements. The bachelor of science, of philosophy, of letters, may have pursued studies entitled to be called liberal; the same may be true of the bachelor of laws, divinity, music, of others in the list; but it is certain that the holders of most of these degrees have acquired a technical rather than a general training. Why, then, it may be asked, should they lay claim to the title to which usage has attached a different meaning? Is it historically just, or is it practically wise, to disregard the distinction between a technical and a liberal education by applying the baccalaureate title indifferently to both? Most of the colleges represented in the conference distinguish between the bachelor's degrees of arts, science, and philosophy, and the technical degrees, practical chemist, mining engineer, civil engineer, and the rest. It is important that those who hold to the old idea of a broad training in fundamental studies, precedent to specialization, should do this.

A question might arise as to what modifications of the baccalaureate title should be considered permissible under this principle. The degrees, bachelor of science, letters, and philosophy, are so well established that it is probably useless to make any objection to them; yet it is a fair question whether the subdivision is of any advantage. If these degrees do not certify to a course of study probably ranked as liberal, they ought not, according to this view, to be conferred; if they do, would not the simpler, more historical, more intelligible way be to comprise them all under the bachelor of arts? The contrast between the sciences and the humanities it may be well to recognize by retaining the bachelor of science; but bachelor of letters and bachelor of philosophy are of such indeterminate

significance that it would be a relief to have them abandoned. Is it worth while to retain degrees whose significance no one can tell without knowing the institution which conferred them, or then without a careful consultation of the catalogue? It seemed to Professor Griffin that the baccalaureate degree would be greatly augmented in dignity if it were conferred only under the title "bachelor of arts," or, at most, with the variation "bachelor of science."

If the reduction of all the non-technical degrees to a single form, or to two forms, were to be accomplished, it would be necessary to reach a more definite understanding than at present exists as to what constitutes a liberal education. The proposition laid down by President Gilman, that "it is not essential that any one curriculum should be followed in order to attain the degree of bachelor of arts," would now be generally conceded. The rigidly exacted course of study which formerly prevailed in all our institutions is now admitted to be impracticable. The effort to adapt it to the demands of the new sciences, and the modern languages and literatures, made it so fragmentary and kaleidoscopic, so far impaired its disciplinary power, that some change was acknowledged to be inevitable. The only difference of opinion now is as to what subjects shall be insisted upon. The modifications of the bachelor's degree first named (bachelor of science, philosophy, letters) ordinarily indicate that one, at least, of the classical languages has not been pursued. The absence of this acquisition seems to render the bachelor of arts degree unsuitable; and, in default of a scientific specialty, one of the other titles is resorted to. If it were decided to abandon these, what could be done for the class of students for whom they were designed? This must, of course, depend on one's view of what is necessary to a liberal culture. Why not give to those who have studied no ancient language such certificates and titles as best describe their work, and, to those who have sufficiently pursued one, concede the full rank of bachelor of arts?

That a liberal education may be properly held to require a wider historical and moral horizon than the modern tongues alone can give, can hardly be disputed. An acquaintance, at first hand, with the manners and sentiments of a civilization remote from our own, one unmodified by Christianity, is so pre-eminently liberalizing, so quickens one's power of intellectual sympathy, so deepens one's sense of the unity of history, so enlarges the range and perspective of one's thoughts, that it may properly be made the differentia between a general and a special training. But are two ancient languages necessary for this? Is it even necessary that one of the classical languages should be pursued? Would not Semitic or Sanscrit studies, if these should happen to be unaccompanied by Greek or Latin, secure the same end? The main thing is to get a genuine hold upon a distant past.

The literary and æsthetic reasons for the study of the classical languages, that is, of Greek, which is the real issue in the case, it is not necessary to belittle the force of. But how few candidates for the degree of bachelor of arts ever acquire any refinement or delicacy of Greek scholarship! How few teachers — happily there are signal and distinguished exceptions to this remark — teach Greek otherwise than as a grammatical drill, or, at the best, a philological discipline! Was ever the Hellenic spirit and form better reproduced than by Keats, who could not read Greek at all?

It is not, in Professor Griffin's opinion, easy to justify the insistence upon both Greek and Latin as essential to a liberal education. We may be in danger of displaying in behalf of Greek studies something of the same excessive deference to traditionary habits and standards which worked so powerfully against their reception in the fifteenth century. It is undeniable that the majority of men in two, at least, of the so-called learned professions, — law and medicine, — in editorial work and in politics, are not, in the academic sense, liberally educated men. Is not this due in part to the fact that we have been too rigid at certain points, making our education seem remote from life and pedantic? If it should seem wise to bestow the bachelor of arts degree without Greek, we could simplify our

nomenclature by dispensing with the degrees of bachelor of letters and of philosophy; we could carry to full graduation some who now pursue partial courses of study; we could obviate criticisms, which proceed not always from so-called "practical" men, but often from persons abundantly qualified to form an opinion, — graduates, not rarely, of our own institutions.

"But while this additional freedom may wisely be conceded," the speaker went on to say, "it is of the last importance that we insist upon those fundamental subjects which any rational theory of a liberal education must include. President Gilman enumerates these as follows: 'It is essential that the candidate who receives that degree should have received much instruction in (a) ancient and modern languages and literature, (b) in mathematics, (c) in the natural and physical sciences, (d) in historical and moral sciences.' I need not stop to show why these four classes of subjects are essential: we are not likely to disagree about that. Experience has shown, what one's knowledge of human nature would lead one to expect, that young men, left wholly to themselves, will not apportion their time equitably between these different interests.

"Professor West of Princeton took the trouble, three or four years ago, to summarize the choices of elective studies made by members of a recent class at one of our leading colleges. A more careful administration of the system probably prevents, at the present time, such extreme abuse of liberty; yet these facts are instructive as an illustration of a danger against which we need to guard. The first man in standing omitted two of the classes of subjects named by President Gilman, taking no course in mathematics or in science. The second omitted nearly three, taking no course in mathematics, in science (except botany), in philosophy, history, or political science. The third took no science and no philosophy. The fourth took no course in philosophy, history, political science, classics, modern languages. How can we consider a man liberally educated who has studied, during his collegiate residence, no modern language, no ancient language, no logic, psychology, or ethics, no history, no political or social science? Omissions of like significance occur in the case of each of the ten highest men; while the men at the bottom of the class show a marked inclination to the easiest subjects. We cannot plead the example of the German universities, for we have no such preliminary training as the German gymnasias afford. It is obvious that unrestricted liberty of election cannot be permitted. No degradation of the baccalaureate degree is comparable to that which would come from the general adoption of such a system in our colleges. The degree has at present an approximate uniformity of meaning. This would speedily and totally disappear."

The suggestions which Professor Griffin offered, on the basis of President Gilman's paper, are these:—

1. Diminish the evils growing out of the number of our colleges, and the inferiority of some of them, through an agreement among the strongest and best, which would have the force of an authoritative example.
2. Distinguish sharply between the technical and the baccalaureate degrees, reducing the latter to one, or, at most, two forms.
3. Relax the requirement in regard to Greek, accepting one ancient language as sufficient for the bachelor of arts degree.
4. Allow no elections on the part of students that will prevent a suitable distribution of attention between the four great groups of subjects which have been named.

HEALTH MATTERS.

The Rôle of Potable Waters in the Etiology of Typhoid-Fever.

THERE has long been a consensus of medical opinion as to the rôle of drinking-water in the causation of typhoid, and facts to prove an etiological relation are accumulating every year. According to the *Boston Medical and Surgical Journal*, Vaillard

has made a communication to the Société Médicale des Hôpitaux, in which he furnishes new bacteriological proofs.

1. In March, 1889, there broke out in the regiment of cavalry quartered at Melun an epidemic of typhoid-fever, but only one squadron was affected. This squadron made use of the water of a particular well which had been contaminated in some unknown way. Repeated examinations of samples of this water revealed the presence of the *bacillus typhosus*.

2. At Cherbourg there was an epidemic of enteric-fever, affecting particularly a military company. The water-supply of this part of the city had been contaminated by typhoid dejections in a manner easily explicable, and samples of this water showed the *bacillus typhosus* in abundance.

3. Similar facts were noted with regard to epidemics which prevailed last year and the year before at Miranda, at Bourg-en-Bresse, and at Chatellerault.

M. Vaillard's method of identifying the typhoid bacillus seems to have been in accordance with the most approved data of bacteriological science.

At the same meeting, Chantemesse stated some facts of interest respecting the influence of Seine water on the prevalence of typhoid epidemics. It was remarkable, that whenever, from accident happening to the reservoirs or mains of the other water sources, the water of the Seine was distributed to the various departments and drunk by the inhabitants or the soldiery, an epidemic of typhoid appeared.

This statement was corroborated by M. Schneider at a meeting of the Société de Médecine Publique, Dec. 27, 1889, who also showed, by facts that had come under his own observation as military surgeon, that the use of Seine water for drinking had repeatedly been followed by epidemics of enteric-fever. Such an epidemic has recently prevailed in the barracks of Paris, owing to the temporary shutting-off of the water of the Vanne, which seems to be of exceptional purity.

The Grippe and Cholera.

Fears having been expressed as to a possible connection between influenza and cholera epidemics, Dr. Smolenski publishes, in the Russian *Official Messenger*, an elaborate report upon the subject. He points out that the suspicion is not new, and that in 1837 it was discussed by Gluge ("Die Influenza"), and refuted. In fact, influenza or *grippe* epidemics have been known in Europe since 1173, that is, for more than seven hundred years; while the first cholera epidemic appeared in Europe in 1823, but did not spread that time farther than Astrakhan. Six years later it broke out in Orenburg; next year, in Caucasia and Astrakhan again, whence it spread over Russia, and in 1831 reached western Europe. As a rule, influenza spreads very rapidly; and at St. Petersburg in 1782, says *Nature*, no fewer than forty thousand persons fell ill of it on the same day (Jan. 14). In 1833 its progress was also very rapid, and within a few days it appeared at places so far apart as Moscow, Odessa, Alexandria, and Paris; while cholera epidemics are usually slow in their migrations from one place to another. Moreover, influenza is chiefly a winter epidemic, while cholera prefers the spring and the summer.

Dr. Smolenski has further tabulated all influenza and cholera epidemics which have broken out in the course of this century in Europe; and he comes to the following results: influenza broke out in 1816 in Iceland; 1827, in Russia and Siberia; 1830-33, in Europe generally; 1836-37, in Europe; 1838, in Iceland; 1841-48 and 1850-51, in Europe; 1853, in the Faroe Islands; 1854-55 and 1857-58, in Europe; 1856, in Iceland and the Faroe Islands; 1862, Holland and Spain; 1863-64, France and Switzerland; 1866, France and Great Britain; 1867, France, Germany, and Belgium; 1868, Turkey; and 1874-75, western Europe. As to the cholera epidemics during the same period, they were, 1823, Astrakhan and Caucasia (from Persia); 1829, Orenburg (from Turkestan); 1830, Russia (from Persia); 1831-37, various parts of Europe. The next epidemic appeared in 1846 in Transcaucasia (coming from Persia); in 1847 it spread over Siberia and Russia, and in 1848 it was in Europe; in 1849-52 it was followed by feeble outbreaks all over Europe. The third cholera